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Magmatic mineral assemblages of eclogitized and not eclogitized Paleoproterozoic gabbronorites from the Belomorian province, Eastern Fennoscandian shield

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Recognition of magmatic crystallization processes is problematic in high-grade metamorphic terrains. However, sometimes metamorphosed gabbro preserve relics of primary magmatic mineral assemblages that give valuable information about the time and conditions of melt crystallization.
The Belomorian province of the eastern part of the Fennoscandian Shield is characterized by repeated high-pressure metamorphic events during Archean and Paleoproterozoic. Metagabbronorites of age ca. 2.4 Ga are widespread in the Belomorian province(Stepanova, Stepanov, 2010) and in spite of metamorphic alteration they retain relicts of primary igneous mineral assemblages. We have studied eclogitized gabbronorites, from the Gridino area (metamorphosed at P$\sim$19 kbar, T$\leq$930°C, Volodichev, 2005) and metagabbronorites metamorphosed in amphibolite facies conditions (P < 4 kbar, T $\geq$ 700°, Larikova, 2000) outside the Gridino eclogite-bearing zone. Both types of metagabbronorite are characterized by presence of garnet corona textures on the boundary of plagioclase and clinopyroxene. Eclogitized gabbronorites contain also omphacite (up to Jd52), and plagioclase (An17).
It was found that central parts of the both eclogitized and not eclogitized metagabbronorite bodies are well-preserved and retain magmatic textures and primary mineral assemblages that consist of Ol, Opx, Cpx and Pl. Magnesium olivine (Fo81-84) in these rocks is enclosed in euhedral bronzite that also may contain small inclusions of chromite. Rather more ferrous olivine (Fo75) occurs in association with augite, hypersthene and plagioclase (An70).
The magmatic stage of crystallization in eclogized and not eclogized olivine gabbronorites is identical: (Ol1+Crt) → OPx → Ol2+Pl (An70) +Aug →Pl (An45).
The microprobe data on the composition of rock-forming minerals were used to calculate the crystallization pressures and temperatures for the minerals equilibrium with the melt. Calculations of PT-conditions of magmatic mineral assemblage crystallization were carried out using several geotermobarometers (Nimis, 1996, Putirka,1996, 2008).
Relict magmatic assemblages in the eclogitized metagabbronorites were crystallize at the pressure range 4.8-5.6 kbar and in the temperature range 1050-1300°. Non-eclogotised metagabbronorites give the range of pressures 4.1-6.5 kbar and temperature 1100-1200°.
Thus, similar PT-conditions of magmatic crystallization for metagabbronorites that altered at various degrees from different tectonic zones suggest the existence of similar tectonic environments in different zones of the Belomorian province at the time of their crystallization.
The pressure at that melts crystallized was less than 6.5 kbar, but not at pressures more than 8 kbar, as it was previously assumed (Sharkov, 1994, Stepanov, 1981).
Furthermore, the process of eclogitization of the gabbronorites of the Gridino area was separated from the stage of magmatic crystallization in time and was not related with crystallization from the melt as some researchers assume (Sibelev, 2007, Volodichev et al., 2010).